

ARTICLES AND OPINION

EARLY URANIUM MINING IN THE UNITED STATES

This paper, which tells the story of the early days of Uranium mining in the United States, was presented by F J Hahne at the Fourteenth International Symposium held by the Uranium Institute in London, September 1989. This particular symposium had as its theme the bicentenary of the discovery of Uranium by the German chemist Professor Klaproth in September 1789.

[Quantities are quoted in tons and have not been converted into metric tonnes, because of the historical nature of this paper. 1 ton = 1.016 tonnes.]

Uranium mining in the United States is closer to 100 years old than to the 200 years since the discovery of the element. Even then, for much of this time the rock was brought out of the ground for reasons other than its uranium content.

From 1871 to 1905, two types of uranium ore were produced in small volumes for the world market. Front-range Colorado had pitchblende and south-western Colorado provided carnotite (oxidized) ore. Mining methods were entirely manual, with the output being hand-sorted and transported on burros or donkeys to railheads.

After a quiet period of about ten years after 1905, interest in mining uranium ore for radium recovery increased. This, coupled with improved metallurgical research sponsored by the US Bureau of Mines from 1912, led to a significant expansion throughout the Colorado Plateau. The USA dominated the world radium market until high grade ore from the Belgian Congo (Zaire) was first mined in 1921. This ended the radium period in the USA by 1925.

The innovative US miners turned to what was previously considered a poison or contaminate in the ore - vanadium. Colorado Plateau ores previously mined for uranium contained 10 to 20 times as much vanadium. The world steel-making industry began to use more each year as a hardening additive. During this vanadium period, 1925 to 1945, underground miners equipped with 5 to 10 ton sized equipment blasted and shovelled vanadium/uranium ore from the Morrison formation mines. Instead of donkeys, diesel engined trucks carried the ore to regional extraction mills, from where the purified concentrates were shipped to world markets. Colorado increased its share of world production of vanadium to 45 per cent.

The USA committed itself to an atomic weapons programme towards

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the end of the Second World War. The uranium to make the first weapons came from stockpiled African ore. However, in the early 1940s the US government was also quietly processing the ore from old vanadium mine dumps for uranium. After the Atomic Energy Commission (AEC) was formed in 1946, aggressive buying programmes were instituted to develop a US uranium reserve base and production capability.

The period of government involvement in uranium mining, from 1945 to 1967, ends the early mining era explored in this paper. The industry multiplied manyfold during this time, with the combination of government incentives and US entrepreneurial motivation. Over US\$2.5 billion was spent by the government, in addition to large amounts raised on the stock markets. Thousands of prospectors, miners, millers, truckers, geologists, and so on, poured into the Colorado Plateau.

The discovery of uranium by a New Mexico shepherd in 1950, and the 1952 discovery of the Mi Vida deposit in Utah served to fan further the flames started by the government. The small Colorado Plateau mines continued producing, but new uranium mines were developed elsewhere with massive earth-moving equipment and, in the case of Anaconda's New Mexico operations, a dedicated 65-mile railway line linking the mine and mill. Underground mines were sunk to double and triple the depths of the older mines - 1000 feet, 1500 feet and then 2700 feet (830 metres). The boom-time money changed everything: the size of property holdings, the depth of mines, the mill recovery facilities, and even the people.

The metals

To understand the history of US uranium mining one has to understand the interrelation between uranium, radium, and vanadium.

Except for a small quantity of front-range Colorado pitchblende production, most radium production in the early 1900s came from Colorado Plateau carnotite ore. It was not until 1904 that Bertram Boltwood demonstrated that 'the per cent of radium in a mineral appears to vary directly as the per cent of uranium present'. This discovery created a new market for uranium that soon grew far beyond that in the earlier glass/ceramic period. It took 215 tons of uranium carnotite ore to produce between 12 and 13 grams of radium. The carnotite ore also contained 10 to 15 times more vanadium than uranium, although the vanadium was more difficult to extract. This co-product richness allowed many US mines to survive after the radium content of their ores was no longer economic.

This is not a paper on mineralogy, but it is useful to mention that although about 480 minerals are listed as containing measurable amounts of uranium in a 1967 US Geological Survey bulletin, there are many duplicate names for minerals that are essentially the same. The bulletin points out that about 155 distinct minerals represent confirmed and probable species with uranium as an important constituent, to which may be added about 30 more containing minor amounts of uranium and another 20 containing uranium as impurities and intergrowths.

Chronology of the early US uranium industry¹⁻¹⁵

The history of the US uranium industry can be divided into five periods:

- [1871-1905: glass/ceramic](#)
- [1905-1925: radium](#)
- [1925-1945: vanadium](#)

- [1945-1967: uranium \(government\)](#)
- [1967 onwards: uranium \(commercial\)](#)

These are not absolute periods, but indicate the years during which the named product solely defined the market for uranium ores. Some periods continued past the end date given to overlap with the next period. For example, commercial vanadium production has continued to grow to the present time, and the government uranium period extended to 1970 through stretchout contracts. Uranium use in glass/ceramics continued into the 1960s in some places.

The first four of these periods are covered in this chronology.

Glass/ceramic period, 1871-1905

1871. Pitchblende was first identified in the United States in 1871 at mines in Gilpin County, near Denver, Colorado, by a miner from Cornwall in England, Richard Pearce. Pearce was familiar with pitchblende from his work in Cornish mines, and had been sent to Colorado to examine mines owned by the Rochdale Mining Company. The mines had been worked for gold since about 1859, and at the Wood mine in the Quartz Hill area Pearce discovered pitchblende of high grade which had been dumped as waste since it contained no gold.

It occurred in far greater quantities than Pearce was used to seeing in his native Cornwall. He told the mine's manager that pitchblende of this quality was worth £400 per ton in England (then equivalent to US\$2000), and 0.1 tons recovered from the dump was later sold in London for US\$210. Pearce returned to Colorado the following year, and leased the Wood mine. In that year, 1872, three tons of ore were produced. The ore contained about 60 per cent uranium oxide, and sold in London for a total of US\$7500 (US\$2500 per ton). Production continued at the mine until 1884, averaging about 3 tons per year of 60 to 70 per cent grade ore.

1881. Although it is possible that carnotite-type uranium ores were first mined by Indians for use as pigments, the first known discovery of yellow uranium minerals on the Colorado Plateau was in 1881. At that time, Tom Talbert, a prospector, mined a yellow rock from a shallow shaft in the Roc Creek area, an area later included in the Uravan mining district of Montrose County, Colorado. A sample of the rock was sent to Leadville, Colorado, for analysis. It contained only traces of gold and silver and attempts to identify the yellow mineral were unsuccessful.

1894. A new ore body was discovered at the Wood pitchblende mine, which had been closed down for ten years. Mining of pitchblende also started at the nearby Kirk mine in 1897, followed by several other Quartz Hill mines, including Blackhawk, German, and Belcher in the early 1900s. The expansion of these mines was helped not only by the demand for radium, but by export restrictions on Austrian pitchblende from 1903 (designed to protect Austrian radium production from French competition).

Attempts were made to exploit lower grade ores by developing techniques for concentrating ore before shipping. None of these were used on a commercial scale, however, and uranium mining in the Gilpin County area declined after around 1906, although some small-scale production continued. A total of about 330 tons of ore (containing about 60 tons U₃O₈) were shipped from the area while these mines were active, mainly to Britain, France, and Germany. The majority of this was produced from the Wood and Kirk mines between 1897 and 1906.

1896. The 1881 prospect of carnotite was relocated in 1896 by Tom Dullan, who held the Roc Creek claims until 1898. However, in 1897 Gordon Kimball, who was aware of the yellow mineral, met a French chemist, Charles Poulot, who was looking for uranium ores. Since the true nature of the yellow rock defied conventional analyses, Kimball produced a sample of the material for Poulot in the spring of 1898.

Poulot identified the mineral as autunite or uranochre, and by May 1898 Kimball had leased the mine. In June, ten tons of ore, mainly from one pocket, were mined and shipped 92 miles by burros and wagons to Placerville, Colorado, from where it was shipped by rail to Denver and sold for US\$2600. The shipment averaged nearly 21.5 per cent U_3O_8 and sold for US\$12.50 a unit (US\$0.625/lb), which was a penalty price because the ore averaged 15 per cent vanadium.

Later, in Paris, the ore was named carnotite after Adolphe Carnot, a mineral analyst. A sample from this shipment was apparently later also analysed by Marie and Pierre Curie.

1898. Carnotite was also identified in eastern Utah in about 1898. A claim was staked near Richardson in Grand County, Utah, in 1900 by Stephen Lockwood and his partners in the Welsh-Lofftus Uranium and Rare Metals Company. Lockwood corresponded with Pierre Curie, who advised on extraction processes. In 1903, an experimental plant was built at Lackawanna, near Buffalo, New York, to produce uranium oxide and iron vanadate from the Richardson ore. By 1906 it had a capacity of 30 tons per month. However, operations apparently ceased in 1908.

1900. Poulot and Kimball built a pilot plant on La Salle Creek in Montrose County in 1900 to extract concentrated uranium and vanadium oxides from the ore. They succeeded in finding a suitable process, and shipped about 1.5 tons of concentrate containing 40 to 50 per cent uranium oxide and 15 to 17 per cent vanadium oxide, produced from 125 tons of carnotite.

In 1901 they invested US\$8000 in a larger plant with a capacity of 10 tons of ore per day. However, the yields obtained were lower than hoped for, and the plant proved uneconomical. It closed after less than a year. The plant was restarted in 1902 with a modified process, and was taken over by the Western Refining Company in 1903. The process was again modified to produce separate uranium and vanadium concentrates as sodium uranate and calcium vanadate. However, the plant closed down again in 1904. A second plant, one mile south of the first, was built by the Dolores Refining Company in about 1905, but was no more successful, operating for only about three years.

Radium period, 1905-1925

The size of the US radium industry in this first phase of Colorado Plateau mining activity is illustrated in [Uranium ore mined in the US during the radium period](#).

1905. No significant new activity took place in the carnotite areas before 1910, except experimental work. Roc Creek carnotite, though it became significant later, did not have much impact on the early uranium-radium market because of the supply of Austrian radium, the need to improve carnotite milling techniques, and the lack of radium recovery plants in the USA.

1910. The General Vanadium Company acquired property in Paradox Valley, Colorado, in 1910. In this same year, the group which later became the Standard Chemical Company purchased the Thunderbolt

group of claims on the south west side of Paradox Valley. This is part of the group to be known later as the Joe Dandy Camp.

Joseph M Flanery, of Pittsburgh, Pennsylvania, organized the Standard Chemical Company in 1911 to exploit the carnotite deposits. This company became the dominant factor in the mining and processing of radium ore throughout the First World War and until the price drop of 1924, caused by Belgian radium production.

The first shipments of carnotite were sent to France, with 1200 tons shipped in 1912. However, radium extraction plants established in the United States took the bulk of the production from about the end of 1912. The US plants produced 10.5 grams of radium in 1913 and 22.4 grams in 1914, which marked the establishment of a viable industry. Records of production indicate that the US radium mines and recovery plants were fully operational by 1912, and that the US monopolized the world radium market from 1913 to 1922.

1914. As early as 1912, the US Bureau of Mines recognized the need for research into the extraction of radium and vanadium from the carnotite ores. Some doctors in New York City and in Baltimore were interested in acquiring radium for research into the treatment of cancer. To this end, the National Radium Institute was incorporated, and a co-operative agreement was made with the Bureau of Mines to study the commercial production of radium. Under this agreement, the Bureau of Mines provided the skilled chemists and mineral technologists, and the Institute provided the funds for the construction of a radium recovery plant in Denver and for the mining and shipping of ore to this plant. The mining operations were carried on in Long Park on the north east flank of Paradox Valley.

This operation extended from June 1914 to January 1917, during which time 8.5 grams of radium were recovered. This radium became the property of the National Radium Institute, and the findings of the Bureau were published for the use of the industry by Karl Kithil and John A Davis, as Bulletin 193 of the US Bureau of Mines. With the reasonably favourable mining conditions found in Long Park, and by processing the ore in the Denver plant, the Bureau recovered radium at a cost of US\$37.50 per milligram.

1919. The mining of uranium was well established as a going industry by 1919. Conditions under which it was mined were often extreme.

Practically all ore except that milled by the Standard Chemical Company was hand sorted and sacked. Under such conditions, to break even required ore containing 2 per cent U_3O_8 and 3 per cent V_2O_5 mined without complications. Such ores commanded a price of approximately US\$75 per ton at Placerville and other railheads. Some ore that reached market contained 5 per cent U_3O_8 and 8 per cent V_2O_5 .

Ore milled by the Standard Chemical Company contained only 1 per cent U_3O_8 , from which a concentrate was made containing 4 per cent U_3O_8 and 12 per cent V_2O_5 , with a recovery of 83 per cent.

Four companies produced 95 per cent of the uranium ore mined in Colorado in 1919: The Standard Chemical Company operated largely along lower San Miguel River, in Long Park, and in Bull Canyon; The Radium Luminous Material Corporation operated in Long Park and vicinity; The Radium Company of Colorado in Long Park and on Roc

Creek; and The Carnotite Reduction Company in the vicinity of Calamity and Maverick Gulches near Gateway.

The freight haulage per ton from Long Park to Placerville was US\$20; from Gateway to the railway the charge was US\$40. In many areas the ore was moved from the mine to a wagon road by pack train, and in a few cases the pack charge equalled the charge for the wagon haul to the railroad.

Radium ores were also mined in Utah from about 1905 up to 1928. They were mainly from the Thompsons, San Rafael, and Henry Mountains mining districts and accounted for approximately 5 per cent of the total US production of about 12.5 grams of radium during this period; this is representative of between 3500 and 4000 tons of ore containing at least 2 per cent U_3O_8 .

1921. The production of radium from Colorado Plateau ores declined disastrously from 1921, due to the exploitation of extremely rich pitchblende in the Belgian Congo, first discovered in 1913. The first shipment of ore reached Antwerp in Belgium on 5 December 1921. The output of rich ore increased; some shipments contained 60 per cent U_3O_8 . In 1925, production was 4 grams of radium per month, and the price fell sharply. [World prices for radium](#), charts the rise and fall of the first stage of the Colorado Plateau mining effort.

The Belgian monopoly pegged the price of radium at US\$70 per milligram, which was designed to force the American producers off the market. In 1923, the United States Radium Company was the only American firm that isolated radium from currently mined ores. This company continued operations in 1924, but was forced to close its plant in 1925.

The main US radium producing region was part of the Morrison formation. A strip 30 miles wide, extending eastward from the Utah-Colorado border and extending 60 miles south from Gateway, includes all the important Colorado mines operated during the First World War. An equal adjacent area in Utah includes all Utah operations for this period, except the small deposits at Temple Mountain. The Colorado portion of these areas produced by far the greater part of the ore. The recovery of radium was the primary object of these operations, with the recovery of vanadium a secondary one.

[World production of radium between 1898 and 1928](#), as given by the US Bureau of Mines, is interesting in connection with the rise and fall of the industry in the USA. The absence of Canada from the list gives an idea of the relative newness of the uranium mining industry in that country.

The eleven year tenure of the US monopoly in radium resulted in the extraction of approximately 197 grams of radium in US plants. Total production of radium from US ores, for the period 1898 through 1928, amounted to approximately 250 grams. The difference of 53 grams roughly represents the radium extracted overseas from Colorado Plateau ores exported between 1900 and 1912. The total world production of radium up to 1928 amounted to 575 grams, of which US production represented 43 per cent.

Vanadium period, 1925-1945

[US and worldwide vanadium production for 1922 to 1945](#) is shown in a table, and uranium ore production 1926 to 1945 is shown in figure 1 (not available on this server - graphic in preparation).

1925. During the period up to 1936, operations in the carnotite regions of the Colorado Plateau were at a low ebb. Most of the ore produced was treated for its vanadium content, and small mills were built at Naturita and Slick Rock, Colorado, and in the Dry Valley and Henry Mountains areas of Utah. Some high-grade ore was sold to chemical companies for the extraction of uranium, which still had limited uses in the ceramic and chemical industries.

1936. Interest in the region started to increase again by 1936, when the US Vanadium Corporation built a mill at Uravan and resumed mining operations in the vicinity. During the next few years, prospecting and mining increased in intensity and expanded geographically as the demand for vanadium increased. Ore was produced over an area extending from Meeker, Colorado, on the northeast, southward to Durango, Colorado; westward through the northern part of the Navajo Reservation; and northward through the Henry Mountains and the San Rafael Swell in Utah.

During the late 1930s and early 1940s the mill at Naturita, Colorado, was rehabilitated, and new mills were built at Rifle, Loma, Gateway, Durango, and Disappointment Valley, Colorado, and at Blanding and Monticello, Utah. The mills at Durango and Monticello were financed by the government; the others by various private corporations. These enterprises experienced various degrees of success and failure, and at least half of the mills have been dismantled.

1942. During this period, geological activity was also stepped up. In 1942 several parties were sent into the area by the US Geological Survey to study the deposits and evaluate their vanadium potential, because it was apparent that foreign supplies would no longer be available. The tenor of the ore was estimated to be 1.5 per cent V_2O_5 and 0.25 per cent U_3O_8

Also in 1942, in order to stimulate vanadium production even more, the Metals Reserve Company began an ore-purchasing programme and increased the base price paid for vanadium ore. This had the effect of stimulating prospecting and mining and many new deposits were opened up. During 1943 and 1944, a co-operative drilling programme under the joint supervision of the Geological Survey and the Bureau of Mines was carried out to define reserves and aid miners in planning development. Ore was mined during this time almost entirely for its vanadium content; the uranium was discharged with the tailings. At this time several federal agencies co-operated in the building of roads into the various mining areas.

1944. The Metals Reserve buying programme was terminated early in 1944, and there was another slump in mining and milling activities. Although the Manhattan Project was now under way and uranium had suddenly become the keynote of a new age, there was a period of several years in which many of the mines and mills were inactive.

At the end of 1943, eight vanadium mills were in operation with a combined capacity of 795 tons per day, of which two were in Utah: one at Cottonwood, Utah, operated by Blanding Mines Company, had a capacity of 20 tons per day; the other at Monticello, Utah, with a capacity of 100 tons per day, was operated by the Vanadium Corporation of America, agent for the Metals Reserve Company. After the 1944 slump, the Blanding mill ceased operations for six years; and for three years, until 1947, the Monticello facility was mainly used for concentrating uranium contained in tailings.

Uranium period (government), 1945-1967

The amount of uranium ore produced from US mines and received at mills and buying stations from 1946 to 1967 is shown in figure 2 (not available on this server - graphic in preparation).

The value of uranium during the early 1940s cannot be accurately established since all of it was being consumed in the highly secret and expensive atomic bomb project, which by November 1945 had cost US\$2.1 billion. However, uranium oxide was priced at US\$7/lb in 1943, and at US\$20 in 1946. In previous years the oxide had been valued at approximately US\$1/lb after the radium had been extracted.

1946. The Atomic Energy Commission (AEC) was established by President Truman on 28 October 1946. The AEC's early uranium procurement programme was essentially a continuation of the wartime programmes of other federal agencies. From 1945 to 1947, uranium was recovered from vanadiferous carnotite-roscoelite ores and from vanadium mill tailings.

1948. The AEC established an ore buying schedule and began purchasing uranium-vanadium ore in 1948 at the government owned mill at Monticello, Utah. Subsequently 16 purchasing stations were established, 12 in the Colorado Plateau area. This had a stimulating effect, and mining and exploration again picked up. Several other idle mills were reopened and a new phase of activity commenced.

1951. In order to further stimulate mining and exploration, in 1951 the AEC raised its base price for the ore and introduced the added incentive of an initial production bonus.

Exploration programmes were set up by the AEC, and by the Geological Survey acting as an agent of the AEC. These marked the transition from old style surface prospecting to the widespread use of subsurface methods coupled with scientific geological principles. These programmes were markedly successful, especially in the Uravan Mineral Belt. The emphasis had now shifted definitely from vanadium to uranium, and those districts poor in uranium, such as Placerville and Rifle, did not share in the general upturn in market conditions.

1952. Government incentives such as guaranteed ore prices, haulage and mine development allowances, a production bonus for the first 10 000 lbs of U_3O_8 produced, a grade premium allowance, and fringe area allowances, all stimulated the industry through the early and middle 1950s.

A definite turning point in the history of Colorado Plateau mining came with the 1952 discovery of the now famous Mi Vida Mine in the hitherto disregarded Lisbon Valley area. This fired the imagination of people throughout the country and showed that the individual prospector could succeed, even in competition with federal agencies. But more importantly, it indicated that truly large deposits, equal in size to those of Canada, and in marked contrast to the small 'pods' of the Morrison formation, could be found.

1954. Uranium prospecting activity, which had reached a moderate level following the inception of the AEC's buying programme, increased greatly in the years after the discovery of the Lisbon Valley deposits. In the mid 1950s prospecting reached its highest pitch, a veritable uranium rush. Unlike the gold rushes to Sutter's diggings and the Klondike, the uranium prospector was generally well supported. Instead of just a few grubstakers, many prospectors now had multiple investors to participate

in the risks. As a result, perhaps the greatest 'get-rich-quick' boom the USA or any other country will ever experience was initiated.

'Penny' uranium stocks appeared, and on a local level the industry achieved criticality, resulting in the fission of vast tracts into an ever increasing number of mining claims. For several years there was a rash of exploratory drilling and some fairly significant additions to Utah's uranium reserves. Furthermore, much negative drilling work was accomplished, which showed the unfavourability of some tracts once thought to be of high potential.

Government expenditure on exploration and development, refining, and purchase of uranium in the Colorado Plateau constituted a large fraction of the total AEC budget. The AEC had about 15 field parties operating in the area, which had at their disposal about 200 vehicles, 150 house trailers and 22 tracked vehicles, not to mention dump trucks, water trucks, compressors, road graders, and smaller items of all sorts. The Geological Survey was similarly equipped but had fewer field parties.

During 1953, the two agencies each did about half a million feet (150 000 metres) of exploratory drilling. Private industry drilled more than two million feet (600 000 metres) during 1954, more than twice the combined total of the two government agencies, giving an overall total of more than three million feet (900 000 metres) in that year. All types of drilling were employed, including rotary, diamond, and percussion.

The AEC also maintained 12 ore buying stations on the Colorado Plateau. More than 500 mines were in simultaneous operation, and production doubled every 18 months in the period after the AEC entered the market. The number of prospectors in the region may have been of the order of 2000, and it is impossible to calculate the number of local people who indirectly benefited from the immense amount of activity in the area. The population of Moab, at the centre of the uranium area, increased from 1200 to about 4600, which must class it as one of the most spectacular boom towns in the nation.

The effects of this frenetic exploration in the Colorado Plateau spread far beyond the confines of the region. The most obvious evidence of the uranium rush was the multiplication in the number of uranium companies selling stock, not only in Utah, Colorado and New Mexico, but on a nationwide scale. This rivalled the gold and oil stock market booms of different periods. Concrete evidence that uranium was big business is the fact that a score or more uranium millionaires made their fortunes in the Colorado Plateau.

1962. In November 1962, the AEC issued an invitation to companies which held uranium production contracts to defer U_3O_8 deliveries in exchange for an additional contract commitment. This provided for a voluntary deferral of delivery until 1967 and 1968 of a portion of the U_3O_8 previously scheduled for delivery prior to 1967. In return, the AEC offered to purchase, in 1969 and 1970, additional U_3O_8 equal to the quantity deferred until 1967 and 1968. Eleven uranium mills, having 70 per cent of the rated peak capacity, elected to participate in the AEC's stretched-out procurement programme.

As a result, the AEC agreed to purchase approximately 32 500 tons of U_3O_8 , or about 8000 tons per year. In 1967 and 1968, the AEC paid US\$8.00/lb for the U_3O_8 . The uranium delivered in 1969 and 1970 was to be purchased at a fixed price determined for each producer, being 85 per cent of the average production cost per lb for the period 1963 to

1968, plus US\$1.60, subject to a maximum price of US\$6.70/lb. The purchases for the four years were scheduled to total approximately US\$450 million, or slightly over US\$112 million per year, and domestic purchases in 1967 and 1968 were about US\$146 and US\$117 million respectively. Four other mills that did not choose to participate announced their intention to continue production of U_3O_8 for sale to private users.

1969. In January 1969, the AEC announced that it would accept proposals from participants in the stretched-out programme to reduce deliveries in 1969 and 1970, in order to free material for sale to the commercial market. Proposals were received from eight contractors, for delivery reductions in excess of 6000 tons. Six of these were accepted, for a total cutback in deliveries of about 4000 tons.

Cumulative purchases from 1942 to 1970, when AEC procurement ended, amounted to approximately 312 000 tons of U_3O_8 . About 55 per cent of the total, 172 000 tons, had been supplied by US producers, with Canadian producers providing about 24 per cent, and overseas suppliers the remaining 21 per cent (mostly the Belgian Congo and South Africa).

The companies

In the USA, the size of the companies active in the uranium industry has varied from large international firms like Union Carbide, to a single prospector raising funds on the Denver stock market.

Each type of company brought its own unique background and experience to the industry. The copper mining firms brought their open pit mining techniques, the chemical firms transferred their metallurgical processes and developed by-product recovery schemes, and the petroleum companies brought modern in-situ leach methods. [Main companies involved in the industry in the various time periods.](#)

The people

The radioactive nature of uranium has created a history dominated by technology and machinery, but these cannot replace the people. More than any other industry in US history, the uranium industry made celebrities out of common people. It played upon the American dream of rags to riches overnight. Every major breakthrough in the USA was attributable to one person's vision; not to geiger counters, scintillators or recovery equipment.

Radium was touted as the most valuable substance on the face of the earth. The price per gram made it appear precious to even the casual observer. The vanadium period, in contrast, was unremarkable. It was not until the US government desperately needed uranium and was willing to pay bounties and guarantee prices that thousands of people became involved.

The US Mining Law of 1872 grants rights to individual prospectors unmatched in other countries. Valuable property can be claimed by an individual, and the reserved mineral rights can then be sold or promoted in the free market. Some uranium deposits thus claimed were so rich that their owners were paid millions of dollars during the 1950s by companies buying out their rights.

Hollywood even made a movie about the uranium boom in 1954. Prospectors were profiled in Life magazine and in newspapers. The penny stock market became legendary during these boom times. A sampling of some of the names made famous by the industry during this

period follows.

- Charles Steen, an unemployed Texas geologist who discovered the Mi Vida deposit near Moab, Utah, in 1952. This pitchblende discovery was significant for its size, method of discovery, and the wealth it brought its owners.
- Vernon Pick, a displaced journeyman who discovered the Delta Mine at Temple Mountain, Utah. This project was later sold by Pick to an investor, Floyd B Odlum, for \$10 million.
- Paddy Martinez, a Navajo shepherd who, while mending a fence in 1950, discovered rocks that led to the development of the Ambrosia Lake area near Grants, New Mexico.
- A Payne Kibbe, a Salt Lake City stockbroker who issued stock to convert Charlie Steen's Mi Vida Mine into a major stock company, Lisbon Uranium.
- Dean A McGee, one of the first oil company executives to become involved in the nuclear fuel cycle. This marked the end of the government era and the beginning of the commercial era.
- Robert Adams, a Wyoming businessman, successful in prospecting and development, who sold Western Nuclear to Phelps Dodge. Later he went on to found another uranium company, Energy Fuels Nuclear.

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